

Remarks

This Amendment accompanies an RCE and addresses claim rejections set forth in the Final Action mailed January 29, 2004. In the Final Action, the Examiner rejected claims 1-7 and 9-11. Claims 1 – 11 have been canceled. New claims 12 – 26 have been added. Claims 12 – 26 remain for consideration.

The Examiner has previously rejected Applicant's claim 1 as being unpatentable over Zhang et al (USPN 6,391,220) in view of "admitted prior art set forth on page 2, ln 1 – pg 3, ln 7."

In new independent claim 12 distinctions between the claimed subject matter and Zhang in view of "admitted prior art" include, among other things, the fact that each layer formed by Applicant's layer-by-layer (LBL) assembly method has an affinity for the substance of the layer (or substrate) immediately below it. Nowhere does Zhang teach or suggest an LBL assembly formed due to affinities of adjacent layers. Instead, Zhang et al. provides examples of other processes for forming thin films, such as spin coating or electroplating. Although Zhang et al. provide a general statement that, "Any suitable process...can be used to form the conductive laminate", it is clear that Zhang et al. did not contemplate layer affinities, nor did Zhang et al. appreciate the benefit of layer affinities, which allow for the formation of mono-layers at least 100 times thinner than Zhang's, as discussed below and which is a significant advance in the art. Applicant's current invention, as well as Applicant's "admitted prior art" both rely on layer affinities. As such, one skilled in the art would not look to the teachings of Zhang in view of

Applicant's "admitted prior art". Applicant, therefore, asserts that the Examiner's § 103(a) rejection is improper. Applicant's new claim 12 clearly includes limitations specifically directed to affinities:

- (i) applying to said substrate a first aqueous solution or dispersion of a first substance, said first substance having an *affinity* for said substrate, to form a first layer;

and;

- (iii) applying to said substrate a second solution or dispersion of a second substance, said second substance having an *affinity* for said first substance, to form a second layer;

and;

- (b) separating said substrate from said layer-by-layer thin film, overcoming the *affinity* between said first layer of said first substance and said substrate while retaining the *affinity* between said first substance and said second substance in said additional layers.

The teaching of Zhang and Applicant's "admitted prior art" are too different to form the basis of a § 103(a) rejection, as set forth in greater detail below.

First, the fact that the assembly method utilizes the affinity of the substance to the layer (or substrate) immediately below it limits the thickness that can be formed in each layer to approximately a monolayer of the substance of less than 100 nm, which limitation can be found in new claim 12. The average thickness depends on the substance, its concentration, its molecular weight, salt concentration of the solution, solvent, temperature, immersion time, pH

and other factors. Consequently, Applicant's monolayer is at least 100 times thinner than films taught by Zhang et. al. Zhang et al. specifies conducting and insulating layers of 25 microns or less (*see* Col. 5, line 5).

Second, the affinity between the layers is a unique requirement of the LBL process. The LBL process cannot occur without an affinity, which may be electrostatic, hydrogen bonding, van der Waals, or result in the formation of covalent bonds. Other processes for forming thin films, such as spin coating or electroplating as contemplated by Zhang et. al. (*see*, Col. 4, lines 57+) do not require this affinity.

At the time of this invention, the ability to remove the completed LBL film from the substrate seemed contradictory to the ability to form the film because affinity between the substrate and the first substance in solution is required for that formation process. Therefore, this invention cannot be regarded as a mere extension of the other patented technologies. In particular, neither the teachings of Zhang, et al. nor Applicant's "admitted prior art" addresses this dilemma. Applicant's recognition of the problem is clearly set forth on page 3, lines 5-13 as follows:

In the prior art, this process has been limited to applications wherein the substrate and the assembly film remain intact as a unitary structure. This limits the application of films produced through this process to those tolerant of the substrate material. The present invention, however, provides a process wherein the assembled thin film may be separated from the substrate to form a free-standing thin film material overcoming these and other limitations.

Finally, Zhang et al.'s invention is distinguishable in that Zhang's invention is directed

toward electronic circuits. Typical film deposition and patterning procedures for electronic circuits require a very clean environment, very strict purity of starting materials, very sharp and very thin patterns, and more well-defined transitions between each layer compared to the LBL process. A typical LBL process is less complex but it is also less precise. Applicant's invention would not have been obvious to one of ordinary skill in the art from teachings directed toward fabricating flexible circuit structures.

Applicant asserts that new claims 12-26 are supported in the specification. In particular, with regard to claim 12, the limitations "each of said layers has an average thickness of less than 100 nm. . ." is supported in the specification at page 2, lines 1 and 2, which states "[i]norganic particles with sizes on the order of 1-100 nm are arranged in layers to form a film. . ." and in FIG. 1 which shows particles of first substance 16 arranged in a layer having a thickness of a single layer of particles.

Considering the foregoing, it is sincerely believed that this case is in a condition for allowance, which is respectfully requested.

\* \* \* \* \*

This paper is intended to constitute a complete response to the outstanding Office Action. Please contact the undersigned if it appears that a portion of this response is missing or if there remain any additional matters to resolve. If the Examiner feels that processing of the application can be expedited in any respect by a personal conference, please consider this an invitation to contact the undersigned by phone.

Respectfully submitted,

4/29/04  
DATE

Reg. No.: 36,050

Tel. No.: (918) 599-0621

Customer No.: 22206

W 258332.1

  
SIGNATURE OF PRACTITIONER

R. Alan Weeks  
(type or print name of practitioner)

321 S. Boston Ave., Suite 800  
P.O. Address

Tulsa, OK 74103-3318